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Short Communication

Details of a non-fatal human-crocodile interaction in the Laguna del Carpintero, Tampico, Mexico

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Abstract

Human-crocodile interaction in the Laguna del Carpintero, Tampico, Tamaulipas, Mexico has been a growing concern for the last several years, with homeless people being the most affected, although individuals of fixed address have also been involved. The objective of this document is to describe in detail a case of non-fatal human-crocodile interaction in this lagoon and the response of the SOS Crocodile Tampico working group. To document the case, we collected information on the interaction, the causative crocodile and the affected person. On June 8, 2024 a male person was involved in a non-fatal interaction with a 278 cm long crocodile, which caused a fracture in his left leg, requiring him to be transported to the nearest hospital. This event activated the first response team who provided pre-hospital and hospital care; search and capture of the crocodile involved, as well as the custody, handling and final disposal of the crocodile into captivity. Therefore, we consider that inter-institutional coordination between federal, state, municipal, health and crocodile specialists, integrated as the SOS Crocodile working group, is fundamental to rapidly and efficiently attend the interactions with crocodiles in urban areas.

Key words: First response protocol, Morelet´s crocodile, negative interaction, SOS Crocodile working group

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Introduction

The frequency of negative interactions between humans and crocodiles is increasing as a result of the expansion of urban areas, which is leading to the isolation of nearby wetlands and direct competition for space, water, and food resources (Amarasinghe et al. 2015). The city of Tampico, Tamaulipas (Mexico) plays an important role in the state's economy as a tourist destination, with the Laguna del Carpintero being a primary attraction for visitors. Tourist activity in this lagoon has experienced exponential growth over the past two decades, with a diverse range of recreational, sporting, and cultural activities taking place. The site boasts an array of recreational facilities, including a park, fairground, theatre, convention center, sports unit, schools, and a semi-conserved natural area (Fig. 1). The site is home to a population of swamp crocodiles

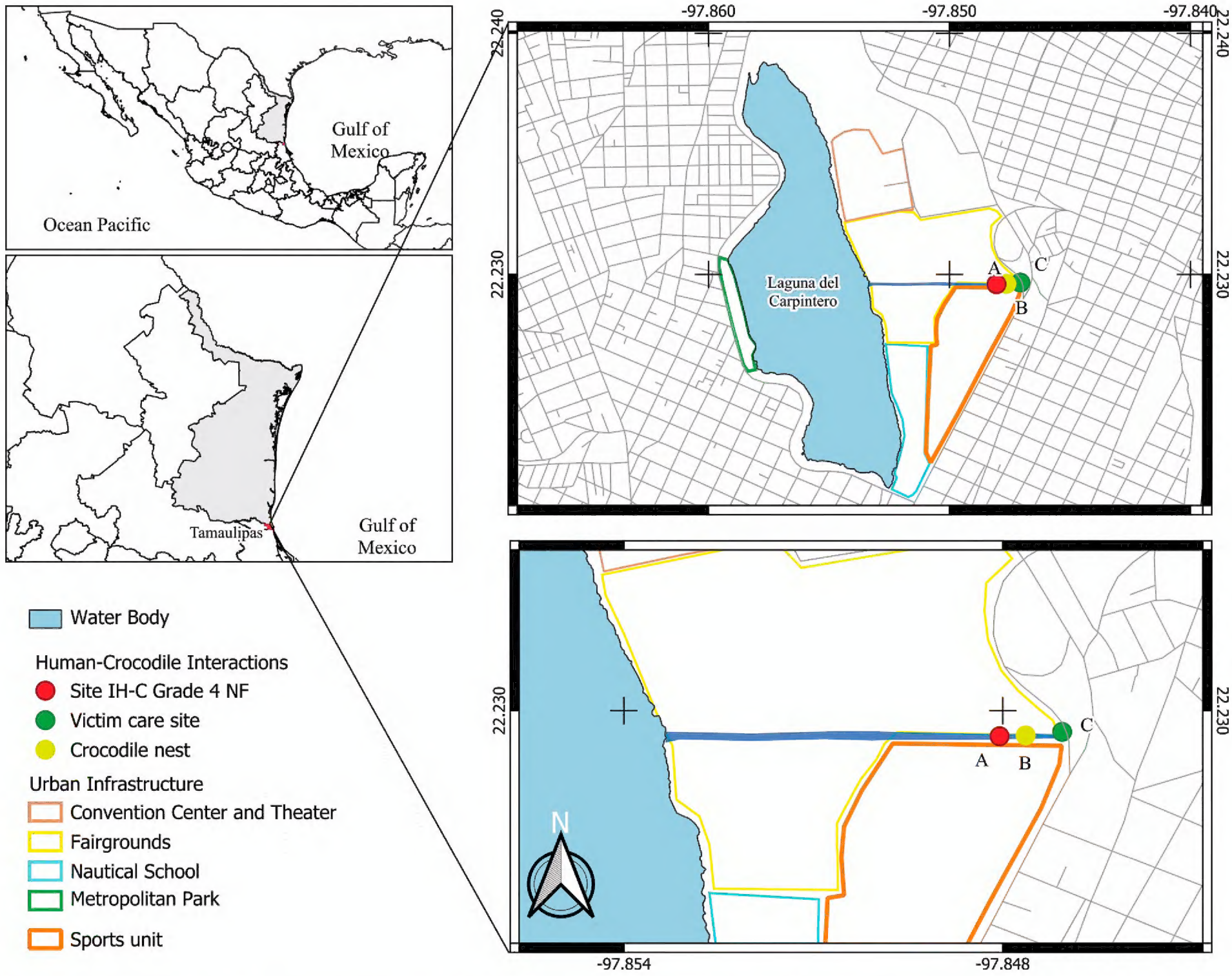

Figure 1. Illustrates the location of Laguna del Carpintero in Tampico, Tamaulipas, Mexico. It indicates the site of the incident, the location of the victim's pre-hospital care, and the position of the crocodile nest. Existing infrastructure in the periphery of Laguna del Carpintero is also shown.

(*Crocodylus moreletii*) that has been studied since 2004. Previous research has indicated that the population is ecologically stable and functional (Carrera 2004; Villegas and Reynoso 2013; Rivera-Téllez et al. 2017). The crocodiles are the primary tourist attraction of the lagoon, and the municipality offers guided trips on outboard motorboats (pontoons) and trams for visitors to observe the crocodiles at their leisure, whether they are swimming or sunbathing in their natural habitat.

Regarding non-fatal human-crocodile encounters (IH-C), it is notable that 25% of such incidents recorded in the state of Tamaulipas occur in Tampico City. The Laguna del Carpintero accounts for 100% of IH-C NF occurrences within this municipality (Cedillo-Leal et al. 2024). In light of these circumstances, the municipality of Tampico initiated an interdisciplinary project in 2020, with the objective of addressing the crocodile population in Laguna del Carpintero. The project's primary objective was the formation of a first response team, designated as "SOS Crocodile Tampico," which included experts from various government agencies, including federal, state, and municipal representatives, as well as specialists in crocodile management, medical professionals, and first aid personnel. This working group adheres to the recommendations set forth in the Protocol for Attention to Human-Crocodile Contingencies (PACH-C)

(SEMARNAT 2018), a document developed by Mexican specialists to address this type of contingency. The PACH-C outlines the recommended courses of action for the resolution of IH-C in Mexico. The objective of this group is to address all reports of interactions with crocodiles, including both sightings and instances of non-fatal and fatal attacks.

In this context, the SOS Crocodile Tampico working group is responsible for the design and proposal of preventive strategies, including the installation of signage along the entire periphery and canals of the lagoon, as well as the organization of talks and training workshops for authorities, civil society, and students from a range of educational levels. These workshops aim to highlight the importance of crocodiles and the prevention of negative interactions. Furthermore, it coordinates surveillance and dissemination actions on radio, television and social networks (Barrios-Quiroz et al. 2021). Regrettably, despite the implementation of preventive strategies and corrective actions, negative interactions with crocodiles were documented during the initial three-year phase of the project (2021–2023), with all cases involving homeless individuals (Cedillo-Leal et al. 2023). In the current year, 2024, for the first time since the project's implementation, two of the three negative interactions that have occurred involved individuals who are not homeless. The purpose of this document is, therefore, to present in detail the response and coordinated actions of the SOS Crocodile Tampico working group to a case of non-fatal human-crocodile interaction in the Laguna del Carpintero.

Methods

The following case study documents a negative interaction between humans and crocodiles that occurred in 2024 in Laguna del Carpintero, located in Tampico, Tamaulipas, Mexico (Fig. 1). The first author gathered data regarding the location of the incident (GPS, WGS84 system). The date and time of the incident were verified by consulting the 911 call records. The incident was classified in accordance with the criteria established by the Protocol for the Attention to Human-Crocodile Contingencies (PACH-C) (SEMARNAT 2018), which specifies five types of human-crocodile interactions.

The crocodile was captured using a pole and a stainless-steel snare placed around its neck to securely capture it (Domínguez-Laso et al. 2011). Without using chemical restraints, the animal was taken to the facilities of the Tampico City Fire Department, where morphometric data were collected: sex (by direct examination of the cloacal cavity) and total length, measured in centimeters with a tape measure (from the tip of the snout to the end of the tail). As for the victim, once he was stabilized in hospital, a visit was made to interview him and record his version of the interaction, while also gathering information on his age, sex and socio-economic situation, and characterizing the injuries caused by the crocodile (number, location and type).

Results

The following section presents a detailed account of the case in question. On June 8, 2024 at 21:00, a report was received via the 911 emergency services hotline. The caller indicated that a person had been bitten by a crocodile in the vicinity of Laguna del Carpintero (22°13.776'N, 97°50.883'W). In response to this

report, an alert was promptly disseminated to members of the SOS Crocodile Tampico working group, who were then instructed to initiate the PACH-C protocol (SEMARNAT 2018). The group personnel (municipal firefighters, state guardsmen, Mexican Red Cross members, and the group's coordinator) promptly proceeded to the site to verify the report. The individual was identified as an adult male and was observed to have crawled a distance of approximately 102 meters from the site of the incident. He was subsequently provided with pre-hospital care by Mexican Red Cross paramedics (Fig. 2A, B) and was then transferred to the Tampico General Hospital "Dr. Carlos Canseco," where the emergency team was already waiting to provide further care. It is noteworthy that the initial response group actively communicates with the hospital personnel responsible for providing subsequent care. This enables the transfer of essential information, including the initial report and photographs of the wounds, allowing for a pre-diagnosis and improved preparation for the eventual reception of the victim.

Following the victim's admission to the medical facility, the incident was classified as Grade 4 (non-fatal) (PACH-C). Thereafter, an incident order was initiated, which outlined the recommended strategies and activities to be conducted in accordance with the degree of interaction. Subsequently, the site where the interaction took place was identified and classified as an open rainwater drainage channel with closed vegetation in the majority of the channel. This channel is situated between the municipal sports facility and the fairgrounds (Fig. 1). The site in question is adjacent to a dirt road that is routinely utilized by the residents of the area for commuting to and from their places of employment.

The exact location of the incident was determined due to the presence of blood and footwear belonging to the victim, in addition to the observation of an adult crocodile in the vicinity, which exhibited a peculiar behavior as it emerged from the water when it perceived our presence (Fig. 2C). Subsequently, we conducted a survey to determine if additional crocodiles were present, during which we observed a second, smaller crocodile at a distance of 42 meters from the site of the interaction. This second crocodile was identified as a nesting female (Fig. 2D). Previously, the nest had been manipulated to translocate the eggs on May 23, 2024, and the nest was destroyed for safety reasons. However, the female constructed a new nest without the presence of eggs (Fig. 2D).

The crocodile that caused the interaction was captured using poles, specifically a PVC tube with a plastic-lined steel cable, which were placed in the crocodile's neck. The capture process was completed in approximately two hours, as the crocodile was introduced into a subway cave, a characteristic habitat of this species. Subsequently, the animal was transported to the facilities of the municipal fire department, where it was temporarily housed, and the relevant data was collected (Fig. 3A–C). The crocodile was identified as a male *Crocodylus moreletii*, measuring 278 cm in total length. It was transferred to the federal authority (PROFEPA) who placed it in permanent captivity to prevent further incidents.

A follow-up interview was conducted with the victim and the medical staff of the hospital to obtain further information regarding the circumstances of the incident, including the number and severity of injuries inflicted by the crocodile. The victim was a 54-year-old adult male who stated that he was not intoxicated or under the influence of any illicit substance. He also indicated that he was a regular visitor to the area, where he was watching a soccer game at the time of the incident. He had decided to walk to the edge of the canal to urinate when

Figure 2. **A, B** prehospital care of the person involved in the human-crocodile interaction (IH-C) Grade 4 non-fatal (NF) in the Laguna del Carpintero, Tampico, Tamaulipas **C** spotting of the crocodile causing the IH-C NF in the pluvial channel **D** spotting of the female protecting nest 42 m from the site of the IH-C NF.

Figure 3. **A** the crocodile responsible for the IH-C NF is held at the Tampico Fire Department facilities **B** delivery to PROFEPA and **C** transfer to final captive facility.

the attack occurred. At that moment, the crocodile seized the individual by the left leg, above the knee, inflicting a substantial injury. During his attempt to defend himself, he suffered a minor injury to his right hand.

The medical report from the emergency department indicated the presence of a 15 cm avulsive wound with irregular edges in the quadriceps femoris, accompanied by exposure of muscle tissue and fracture of the left femur. Consequently, the patient was admitted to the operating room for surgical lavage and trauma surgery, with the objective of placing external fixators and reconstruction of the muscle tissues. The patient was hospitalized for a period of three days and subsequently discharged for recovery at home until the removal of the external fixator, after which he was referred for physiotherapy sessions.

Discussion

This is the first documented incident of a non-homeless individual engaged in a negative encounter with a crocodile in the Laguna del Carpintero since the inception of the SOS Crocodile Tampico working group. It is suggested that this interaction may have been triggered by a number of factors. Primarily, the time of day may have been a contributing factor. While the majority of these events are recorded during daytime hours (Langley 2010), this case was recorded at night. This could have prevented the individual from observing the presence of the crocodile at the site. However, the victim stated during his interview that he was aware of the presence of crocodiles in the area and had observed them basking in the channel on multiple occasions. This assertion is corroborated by the first author of this manuscript, who has observed that male crocodiles are frequently found at close distances (less than 50 m) from the nests and, like the nesting females, they are vigilant at a distance from the nesting area. This finding is consistent with the data collected during the investigation of this case, which revealed that the interaction occurred at a distance of 42 meters from a nest. It is noteworthy that this incident coincided with the reproductive season of the species (April to September), during which the greatest number of interactions are observed. This finding concurs with national and worldwide statistics (Brien et al. 2017; García-Grajales and Buenrostro-Silva 2018; Khan et al. 2020).

The creation of a first response task force to address negative interactions between humans and crocodiles has the potential to be a critical factor in preventing severe outcomes for victims. The communication between the various actors within this group enables a reduction in the time elapsed between the incident and the provision of hospital care. As soon as the SOS Crocodile Tampico working group is alerted, the emergency area is already aware and can evaluate the type of injury in advance. This is achieved through the information and images sent from the site of the incident, ensuring that the necessary material, area and personnel are prepared to attend the case.

Conclusion

The SOS Crocodile working group is a collaborative network of governmental agencies at the federal, state, and municipal levels, in addition to healthcare professionals and crocodile experts. This working group is becoming an invaluable resource in the resolution of the socio-environmental challenge of man-

aging human-crocodile interactions. The increase in crocodile sightings and interactions with humans has been exacerbated by the process of urbanization, which is encroaching upon the crocodile habitat.

In Tampico, the proximity of the Laguna del Carpintero and the consequent increase in human activity in its periphery has heightened the risk of negative encounters with the crocodile, which is now widely regarded as a potentially dangerous animal. In light of these concerns, the SOS Crocodile team has also engaged actively in the implementation of a range of strategies to both reduce the likelihood of negative interactions in the lagoon and to promote a culture of coexistence and prevention among visitors to this urban wetland. These strategies include:

a. Installation of signage and radio and television campaigns to promote a cultural shift towards incident prevention;
b. Construction of a perimeter fence around the lagoon;
c. Facilitation of training courses on crocodile management and human-crocodile interactions;
d. Routine surveillance of the lagoon's periphery.
e. Environmental education programme for students and tour operators, with a particular emphasis on crocodiles and their importance.

In addition to the initiatives outlined above, this working group undertakes annual monitoring of the crocodilian population and collaborates with crocodilian researchers to conduct studies on topics such as environmental pollution and crocodilian health.

Despite the animal's dangerous reputation, however, the Morelet´s crocodile also evokes feelings of fascination and interest among people. The work of the SOS Crocodile Tampico working group, therefore, extends beyond the provision of victim care in the event of an attack. It also aims to foster awareness of the importance of coexistence with this reptile, which plays a fundamental role in maintaining the ecological balance within the wetlands it inhabits.

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Additional information

Conflict of interest

The authors have declared that no competing interests exist.

Ethical statement

No ethical statement was reported.

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Author contributions

César N. Cedillo-Leal: fieldwork, writing, original draft and revision. Gabriel Barrios-Quiroz: writing, revising, translating and editing. Sergio E. Padilla-Paz: writing, translation and editing.

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Data availability

All of the data that support the findings of this study are available in the main text.

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